

CLAIMS

1. A high reliability gas mixture backup system for delivering a precise gas mixture, the system comprising:

5 a high pressure gas mixture storage system that delivers the precise gas mixture for a short duration of time; and

a cryogenic liquid blending gas mixture generation system that delivers the precise gas mixture for an extended duration of time

10 wherein the high pressure gas mixture storage system and the cryogenic liquid blending gas mixture generation system deliver an uninterrupted supply of the precise gas mixture.

2. The high reliability gas mixture backup system of claim 1, wherein the high pressure gas mixture storage system comprises at least one high pressure storage vessel.

15 3. The high reliability gas mixture backup system of claim 1, where the high pressure gas mixture storage system is pressurized to 2:1 to 40:1 of a required delivery pressure.

4. The high reliability gas mixture backup system of claim 1, where the high pressure gas mixture storage system is pressurized by at least one high pressure vaporization
20 vessel using compressed gas directly from a primary gas mixture generation system.

5. The high reliability gas mixture backup system of claim 1, where the high pressure gas mixture storage system is pressurized by at least one cryogenic pump using compressed gas directly from a primary gas mixture generation system.

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6. The high reliability gas mixture backup system of claim 1, where the high pressure gas mixture storage system comprises a cryogenic liquid charging system that provides the precise gas mixture at a required high pressure storage vessel pressure.

5 7. The high reliability gas mixture backup system of claim 1, where the high pressure gas mixture storage system comprises a high pressure product compressor that provides the precise gas mixture at a required high pressure storage vessel pressure.

8. The high reliability gas mixture backup system of claim 1, where the short duration
10 of time wherein the high pressure gas mixture storage system provides the precise gas mixture for up to 20 minutes.

9. The high reliability gas mixture backup system of claim 1, where the cryogenic liquid blending gas mixture generation system uses cryogenic liquids that can be stored at low
15 pressures, above a required delivery pressure.

10. The high reliability gas mixture backup system of claim 1, where the cryogenic liquid blending gas mixture generation system comprises components that require energy which are all pneumatically operated by pressure generated by a common
20 cryogenic liquid vaporization pneumatic back-up system.

11. The high reliability gas mixture backup system of claim 1, where the cryogenic liquid blending gas mixture generation system has monitors that are in communication with the high pressure gas mixture system to determine if the high pressure gas mixture
25 system is providing a the precise gas mixture.

12. The high reliability gas mixture backup system of claim 11, where the monitors are at least one selected from pressure sensors, flow sensors, and valve position sensors.

13. The high reliability gas mixture backup system of claim 1, further comprising a
5 sensor that is in communication with the high pressure gas mixture system and the cryogenic liquid blending gas mixture generation system that signals the cryogenic liquid blending gas mixture generation system to begin preparing the precise gas mixture.

14. A high reliability gas mixture backup system for delivering a precise gas mixture,
10 the system comprising:

a high pressure gas mixture storage system that delivers the precise gas mixture for up to 20 minutes, is pressurized to 2:1 to 40:1 of a required delivery pressure, and comprises at least one high pressure storage vessel; and

a cryogenic liquid blending gas mixture generation system that delivers the
15 precise gas mixture for an extended duration of time, uses cryogenic liquids that can be stored at low pressures above the required delivery pressure, and comprises at least one monitor that is communication with the high pressure gas mixture system to determine if the high pressure gas mixture system is providing the precise gas mixture. .

20 15. The high reliability gas mixture backup system of claim 14, wherein the high pressure gas mixture storage system is pressurized by at least one high pressure vaporization vessel using compressed gas directly from a primary gas mixture generation system.

16. The high reliability gas mixture backup system of claim 14, wherein the high pressure gas mixture storage system is pressurized by at least one cryogenic pump using compressed gas directly from a primary gas mixture generation system.

5 17. The high reliability gas mixture backup system of claim 14, wherein the high pressure gas mixture storage system comprises a cryogenic liquid charging system that provides the precise gas mixture at a required high pressure storage vessel pressure.

18. The high reliability gas mixture backup system of claim 14, wherein the high
10 pressure gas mixture storage system comprises a high pressure product compressor that provides the precise gas mixture at a required high pressure storage vessel pressure.

19. A process for providing an uninterrupted supply of a precise gas mixture from a
15 high reliability gas mixture backup system comprising:

providing a high pressure gas mixture storage system;

providing a cryogenic liquid blending gas mixture generation system;

delivering a precise gas mixture from the high pressure storage system for a short duration of time; and

20 delivering the precise gas mixture from the cryogenic liquid blending gas mixture generation system for an extended duration of time.

20. The process of claim 19, wherein the high pressure storage system comprises at least one high pressure storage vessel.

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21. The process of claim 19 wherein the high pressure gas mixture storage system is pressurized to 2:1 to 40:1 of a required delivery pressure.

22. The process of claim 19 wherein the the high pressure gas mixture storage system is pressurized by at least one pressure vaporization vessel using compressed gas directly from a primary gas mixture generation system.

23. The process of claim 19 wherein the high pressure gas mixture storage system is pressurized by cryogenic pumps using compressed gas directly from a primary gas mixture generation system.

24. The process of claim 19 wherein the high pressure gas mixture storage system comprises a cryogenic liquid charging system to provide the precise gas mixture at a required high pressure storage vessel pressure.

25. The process of claim 19 wherein the high pressure gas mixture storage system comprises a high pressure product compressor to provide produce the precise gas mixture at a required high pressure storage vessel pressure.

26. The process of claim 19 wherein the instantaneously delivering step is conducted for up to to 20 minutes.

27. The process of claim 19 wherein the cryogenic liquid blending gas mixture generation system comprises cryogenic liquids that can be stored at low pressures, above a required delivery pressure.

28. The process of claim 19 wherein the cryogenic liquid blending gas mixture generation system comprises components that require energy which are all pneumatically operated by pressure generated by a common cryogenic liquid vaporization pneumatic back-up system.

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29. The process of claim 19 wherein the cryogenic liquid blending gas mixture generation system comprises at least one monitor in communication with the high pressure gas mixture system to determine if the high pressure gas mixture system is providing the precise gas mixture.

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30. The process of claim 29 wherein the at least one monitor is selected from a pressure sensor, a flow sensor, and a valve position sensor.

31. The process of claim 19 wherein the cryogenic liquid blending gas mixture generation system comprises a sensor that is in communication with the the high pressure gas mixture system that signals the cryogenic liquid blending gas mixture generation system to provide the precise gas mixture.

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